WATER MANAGEMENT IN ALBERTA

CHALLENGES FOR THE FUTURE

BACKGROUND PAPER

VOLUME 7

GROUNDWATER

Alberta
ENVIRONMENT

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SUMMARY

VOLUME 7: GROUNDWATER

CHAPTER 1: GROUNDWATER MANAGEMENT

Groundwater, as an integral part of the hydrologic cycle, has ecological and economic value. It is vital for sustaining life and health and is a basic resource for industrial and agricultural development. The background paper volume seven describes the legislation and current policies that govern groundwater as well as issues for future consideration.

Currently, the ***Water Resources Act*** deals with the licensing and use of groundwater. The ***Groundwater Development Act*** protects the quality and quantity of groundwater by gathering information on the sources of groundwater, by ensuring the use of appropriate well drilling and construction materials, and by seeing that resources are developed by the proper methods.

Alberta Environment maintains an inventory of Alberta groundwater resources through a province-wide groundwater database, a network of observation wells, and a program of systematic hydrogeologic mapping.

Conservation of groundwater is encouraged and often required. For example, Alberta Environment and the Energy Resources Conservation Board have jointly developed water recycling guidelines for "In Situ Oil Sands Facilities in Alberta." The Minister of the Environment, in 1990, adopted a policy on the use of potable groundwater for oilfield injection that includes quantity limitation and time limit restrictions. As well, Alberta Environment cooperates with other organizations and agencies to ensure public involvement and education in groundwater issues.

For new or enhanced legislation, it is necessary to develop a better understanding of the inter-relationship of the various phases of the water cycles, of the effects of man-caused pollution, and of the results of wastage. Groundwater management has to be actively integrated in the management of the sustainable development of our natural resources.

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TABLE OF CONTENTS

VOLUME 7: GROUNDWATER

Summary

Chapter 1: Groundwater Management 1

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GROUNDWATER MANAGEMENT

INTRODUCTION

Groundwater, as an integral part of the hydrologic cycle, has ecological and economic value. It is vital for sustaining life and health and is a basic resource for industrial and agricultural development.

Groundwater is a Crown-owned resource. By mandate under the ***Water Resources Act***, ***Groundwater Development Act***, ***Clean Water Act***, and other appropriate legislation, Alberta has developed long-term policies to protect and conserve groundwater by preventing pollution and over-use. These policies are comprehensive, consistent with good management, and take into account the sustainable development of other sectors.

GOVERNMENT STRATEGIES

The Government of Alberta has the right to control groundwater diversion and use, as well as all activities with a potential impact on the quality and quantity of the groundwater resources. To protect, conserve, and make best use of these groundwater resources, the Province has given Alberta Environment the mandate to manage the resources through legislation and policies. Accordingly, protection and conservation measures target the prevention of groundwater pollution and over-use. Such measures include monitoring groundwater conservation policies through allocation priorities and limits, regulating groundwater development activities, compiling groundwater inventories, and developing guidelines for industry and waste disposal sites. These measures take into account such factors as ecological assessments of the impacts of industrial, agricultural, and other activities on groundwater.

To ensure sustainable use of groundwater through allocation policies, consideration is given to the amount of groundwater in reserve and its rate of replenishment.

LEGISLATION

The ***Water Resources Act*** deals with the use of water resources and the allocation of water rights in Alberta. It establishes the Province of Alberta as the owner of all waters in the province and vests the government with the authority to determine how all provincial waters are used and who may use them. Ownership and responsibility for management apply to both surface and groundwater.

The Act requires that a licence or permit be obtained to divert and use surface or groundwater for all purposes other than domestic as defined in the Act.

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The ***Ground Water Development Act*** protects the quality and quantity of provincial groundwaters by gathering information on the sources of groundwater by ensuring the use of appropriate well drilling and construction materials, and by seeing that proper methods of developing the resources are used.

Under this Act, wells must be drilled by licensed firms employing qualified drillers who must successfully complete a two-year apprenticeship program. Drillers must submit a driller's report to the well owner and to Alberta Environment for every testhole or well drilled. These reports form an inventory of all wells drilled in Alberta. Regulations under the ***Ground Water Development Act*** require unused water wells to be filled in properly when abandoned in order to protect aquifers against contamination.

The ***Ground Water Development Act*** is one of the statutes being incorporated into the ***Alberta Environmental Protection and Enhancement Act,*** with new elements being added that will strengthen, among other things, its groundwater protection and conservation components.

INVENTORY

For meaningful long-term groundwater management, there is a need for sound knowledge of how much and where groundwater is available in the province. An inventory of Alberta groundwater resources, including their quantity and quality characteristics, is made through the development, maintenance, and continuous update of a province-wide groundwater database, a network of observation wells monitoring major aquifers and a program of systematic hydrogeologic mapping. All information is readily available to the public.

Alberta Environment maintains a groundwater database at its Groundwater Information Centre (GIC). The primary purpose of the Centre is to collect, store and disseminate hydrogeological information pertinent to Alberta, including water well drillers' reports, geophysical logs, water well chemistries, pumping test data. All collected well data are stored as paper files and on microfiche. Some of the data are also computerized. In addition to various hydrogeologic parameters (well depth, water level, yield, aquifer characteristics, etc.), other data available include information about the well owner, driller, drilling dates, type of well construction, and intended use of the water. All wells are indexed and filed by land location. Presently the Centre has information on over 320,000 wells and springs with approximately 10,000 new ones added annually.

The Centre also endeavors to maintain copies of groundwater-related reports pertaining to Alberta and written by researchers, consultants and government agencies. Bibliographic summaries are produced annually, arranged by author and map sheets of the National Topographic System.

This extensive database serves the public by providing groundwater-related information when requested. More than 5,000 inquiries each year are handled by the Centre. These requests originate from private citizens, water well drillers, consultants, industrial firms, developers and government agencies.

A network of groundwater observation wells operated by Alberta Environment monitors water levels and quality of the major aquifers throughout the province. Well sites are selected based on the anticipated need for the data, information already available, test drilling results, aquifer characteristics, and location. Currently there are over 340 observation wells ranging in depth from 6 to 240 m. The monitoring consists of well testing, periodic sampling, and discrete or continuous water level measurements. Over 30 years of data is available for some wells. This monitoring is similar in function to flow measurements made at stream gauging stations for the determination of surface-water flow. Between 5 to 8 observation wells are added annually to this network.

To complement the extensive data-gathering programs described above, Alberta Environment has initiated a program of hydrogeologic mapping that is a natural follow-up to the pioneering reconnaissance map series executed by the Alberta Research Council in the 1960's and 1970's. This new mapping is done in sufficient quantitative and interpretive detail so as to be readily useful for groundwater management, planning, protection, preservation and responsible use of groundwater; as well, it enables the Department to advise, license, and arbitrate in relevant matters.

GROUNDWATER PROTECTION

Protecting groundwater resources against overuse, mining, and pollution should be an integral component of any management strategy.

Minimum water well construction and abandonment standards are stipulated in Alberta under the existing ***Ground Water Development Act***. Abandonment standards of wells, holes or other structures constructed for non-water purposes, related purposes, i.e. for mineral exploration, are proposed for incorporation into regulations under the ***Alberta Environmental Protection and Enhancement Act*** because they may affect the withdrawal or quality of groundwater. Maintenance responsibilities of water wells by owners have been strengthened.

Projects from any economic sector that are expected to adversely affect aquifers are the subject of an assessment procedure aimed at evaluating a project's possible impact on the water regime and/or the quality of groundwater resources. Impact assessment surveys continue during the construction and operational phases of a project in order to keep under control and correct any adverse impacts on groundwater resources during and after human interventions.

Impact assessments are undertaken at an early stage of project-planning and are systematically applied to the different alternatives considered in a project study. It is essential that results of impact assessment procedures be taken into account in decision-making, and that systematic monitoring of project realization by competent authorities be conducted to ensure compliance with conditions of groundwater protection.

ALLOCATION

According to Section 11 of the ***Water Resources Act***, a person may obtain a licence to divert and use groundwater for a variety of purposes. Licensing is required for the use of groundwater for municipal, irrigation (including greenhouses and market gardens), agricultural (cow-calf operations, feedlots), industrial, and a variety of uses designated as "other".

Permits are required to divert and use groundwater on a temporary basis. They can be issued for any licensable water supply project but are most often issued for construction camps, pilot plants, dewatering constructions, or mine sites and oilfield injection.

Approval to divert and use groundwater is not required for domestic farm use including a garden up to one acre, household use on property owned or occupied by the well owner (such as an acreage), wells equipped with hand pumps, or small quantities of groundwater used for human consumption in industrial buildings (e.g. gas plants).

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It is noteworthy that under existing legislation, domestic use of water from a well serving more than two households is licensable. Such differentiation has created some confusion and requires clarification.

Obtaining approval, whether a licence or temporary permit, to divert and use groundwater is a two-step process. The first step is to apply for an exploration permit. The application will outline the location of the proposed well or wells, the quantity of water needed, and the time-frame of use (all year, seasonal, etc.). The application is evaluated on a site-specific basis considering known hydrogeological information for the area and locations of other water users in the area. An exploration permit will be issued if it is feasible to proceed to an investigative phase. Terms and conditions outlining technical information such as pumping test data that must be obtained and analyzed will be attached to the exploration permit. The analysis of this data will be used in support of an application for licence.

The application for licence is the second step in the approval process. Department specialists evaluate the technical data accompanying the application. An approval in the form of an interim license or temporary permit to divert and use groundwater will be issued only when the department is satisfied the diversion can proceed without causing the following:

- unacceptable interference with other water users, whether domestic or prior licencees;
- mining of the source aquifer itself to the point of causing permanent depletion; or
- causing harmful effects on the environment in general.

Advising local residents of a proposal to divert and use groundwater through insertion of a public notice in one or more locally distributed newspapers is a requirement under the ***Water Resources Act***. It should be noted that waiving the need for advertising public notices can be requested. Waiver may be granted in certain circumstances such as when sufficient public input on a particular project, including the proposed water source, has taken place as a result of public meetings or hearings. If notice is given, the public has 30 days to file statements of objection which the Minister must consider when making a decision on the application of licence.

It should be noted that there is no requirement for holding a public hearing even when objections have been filed with the department. However, it is common for the proponent or the department to meet with local residents to share information on the technical aspect of the proposal and on the department's water allocation procedures.

CONSERVATION

Groundwater users are encouraged and often required to conserve the resource. For example, Alberta Environment and the Energy Resources Conservation Board have jointly developed water recycling guidelines for "In Situ Oil Sands Facilities in Alberta." The guidelines apply to both surface and groundwater diversions. They require all operators with freshwater requirements exceeding approximately 400 acre-feet (500,000 m^3) per annum to recycle produced water on site. Operators have demonstrated that water recycling at large scale projects can be both efficient and economical.

Though not legally required, recycling of groundwater used in gravel-washing operations has been found generally advantageous, and is becoming more common.

In March, 1990 the Minister of the Environment adopted a policy on the use of potable groundwater for oilfield injection (secondary oil recovery).

The policy was prepared by Alberta Environment with input from various rural, agricultural and industrial groups. A variety of safeguards were built into the policy to be applied to proposals to divert and use groundwater for oilfield injection purposes in the agricultural (white zone) areas of the province.

The following are two significant elements of the policy:

Quantity Limitation

An applicant who receives an approval to use potable (usable) groundwater for oilfield injection purposes will be restricted to a maximum of one half of the long-term yield of a given aquifer in the immediate vicinity of the water source well. This will be enforced by limiting water level decline, as measured in an observation well located 150 metres from the water source well, to 35 percent of the available head (saturated thickness of the aquifer) during the first year of operation and no more than 50 percent over the life of the project.

Time Limit Restriction

All initial approvals will be limited to a one-year time period. After one year, a five-year extension will be issued only if the aquifer is performing in accordance with the terms and conditions of approval and without an unreasonable negative impact on other wells in the community. Future annual extensions will automatically be granted within a five-year approval period if the required conditions are met and no other applications exceeding the remaining available aquifer capacity have been received from the surrounding community.

It should be noted that an appropriate level of investigation into the use of surface water, non-potable groundwater and non-water alternatives must be carried out by the applicant,prior to the submission of an application to develop a potable groundwater source for oilfield injection purposes.

Also, any monitoring stations associated with the diversion of groundwater must be available for inspection by designated local officials and affected parties to ensure that the community has immediate and accurate information on the aquifer performance.

EDUCATION AND INFORMATION

For resource management strategies to be successful, public involvement, education, and information are essential. Alberta Environment, in co-operation with local authorities and organizations, has successfully promoted the annual "Environment Week" events where groundwater-related topics are exposed and discussed through displays, conferences, school sessions and informal presentations. It has also published various brochures, including "The Ground Water Information Guide," and organized technical seminars and public meetings.

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GROUNDWATER MANAGEMENT AND THE FUTURE

Thanks to progressive thinking regarding environmental issues in general, groundwater can no longer be considered independently of the other phases of the hydrologic cycle, nor in fact in isolation of other environmental elements. For groundwater management itself to be meaningful and effective, it has to be viewed in the larger context of the ecosystem we live in.

Parallel to new or enhanced legislation that pays continued attention to the maintenance, protection and development of the environment and its resources for the benefits of present and future generations, it is imperative to develop a better understanding of the inter-relationship of the various phases of the water cycles, e.g., surface water and groundwater interaction in a lake area; also, people need a better understanding of the behavior of groundwater when affected by human-caused pollution, or by wastage, as in the case of water well overflow.

In a province where groundwater is increasingly important and becoming essential for domestic as well as industrial purposes, groundwater management must be actively integrated into the sustainable development of our natural resources.